

**CONVERTING A MOBILE KITCHEN TRAILER
TO A MOBILE MEDICAL PLATFORM:
A FEASIBILITY STUDY**

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
Fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

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1999

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
4 June 1999

3. REPORT TYPE AND DATES COVERED
Master's Thesis, 7 Aug 98 - 4 Jun 99

4. TITLE AND SUBTITLE
CONVERTING A MOBILE KITCHEN TRAILER TO A MOBILE MEDICAL PLATFORM: A FEASIBILITY STUDY

5. FUNDING NUMBERS

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Command and General Staff College
Graduate Degree Programs
1 Reynolds Avenue, Bell Hall, Room 123
Fort Leavenworth, KS 66027-1352

8. PERFORMING ORGANIZATION
REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING / MONITORING
AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

A

13. ABSTRACT (Maximum 200 words)

In the near future, it appears that the missions of the U.S. Army in combat and non-combat roles will rely more on mobility. Many combat units have been able to field more modern tanks, and fighting vehicles making them more mobile. However, many medical supporting units have not modernized their ground vehicles. This is due in part to a lack of funding for medical vehicle modernization. More mobility may only be a part of the problem of medical support. The ability to haul more medical supplies, and to set-up and tear-down quickly are factors in the mobility of medical support. Given the recent medical budget trends, adapting a piece of existing U.S. Army equipment for medical use could be a low cost solution. This study sampled current doctrine, after action reports, and near future predictions, in order to delineate requirements for medical support. Then current capabilities were sampled to establish medical support capabilities. This review noted medical mobility as a possible shortfall for medical support. This study proposed the idea that a U.S. Army Mobile Kitchen Trailer could be easily modified into a mobile medical platform. This platform could be configured into an operating room, pre-op/post-op room or emergency room. This adaptation was compared to the existing tent set-up of a Forward Army Surgical Team (FST), and a battalion aid station. Further comparison was made between two other mobile tent systems called a DRASH and a ASSTC for fielding with the FST. This study used the Military Decision Making Process to make feasibility (comparison) statements. This study concluded that the adaptation of an Army Mobile Kitchen Trailer was a more feasible solution for the near future requirements to improve the mobility of medical support units.

14. SUBJECT TERMS

Mobile Kitchen Trailer, Medical Platform

15. NUMBER OF PAGES
79

16. PRICE CODE

17. SECURITY CLASSIFICATION
OF REPORT
UNCLASSIFIED

18. SECURITY CLASSIFICATION OF THIS
PAGE
UNCLASSIFIED

19. SECURITY CLASSIFICATION
OF ABSTRACT
UNCLASSIFIED

20. LIMITATION OF ABSTRACT
UNLIMITED

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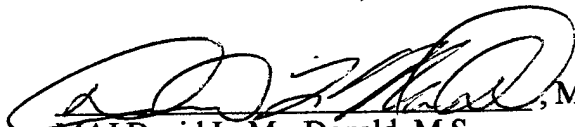
THESIS APPROVAL PAGE


Name of candidate: MAJ(P) R. Todd Dombroski, D.O.

Title of thesis: Converting a Mobile Kitchen Trailer to a Mobile Medical Platform: A Feasibility Study

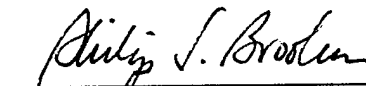
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The opinions and conclusions expressed herein are those of the student author, and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. References to this study should include the foregoing statement.)

ABSTRACT

CONVERTING A MOBILE KITCHEN TRAILER TO A MOBILE MEDICAL PLATFORM: A FEASIBILITY STUDY, by MAJ(P) R. Todd Dombroski, D.O., MC, USA, 73 pages.

In the near future, it appears that the missions of the U.S. Army in combat and non-combat roles will rely more on mobility. Many combat units have been able to field more modern tanks, and fighting vehicles making them more mobile. However, many medical supporting units have not modernized their ground vehicles. This is due in part to a lack of funding for medical vehicle modernization. More mobility may only be a part of the problem of medical support. The ability to haul more medical supplies, and to set-up and tear-down quickly are factors in the mobility of medical support. Given the recent medical budget trends, adapting a piece of existing U.S. Army equipment for medical use could be a low cost solution.

This study sampled current doctrine, after action reports, and near future predictions, in order to delineate requirements for medical support. Then current capabilities were sampled to establish medical support capabilities. This review noted medical mobility as a possible shortfall for medical support. This study proposed the idea that a U.S. Army Mobile Kitchen Trailer could be easily modified into a mobile medical platform. This platform could be configured into an operating room, pre-op/post-op room or emergency room. This adaptation was compared to the existing tent set-up of a Forward Army Surgical Team (FST), and a battalion aid station. Further comparison was made between two other mobile tent systems called a DRASH and a ASSTC for fielding with the FST.

This study used the Military Decision Making Process to make feasibility (comparison) statements. This study concluded that the adaptation of an Army Mobile Kitchen Trailer was a more feasible solution for the near future requirements to improve the mobility of medical support units.

ACKNOWLEDGEMENTS

The completion of this thesis is due to the continuous support and assistance from family, friends, and associates. First and foremost is the support and sacrifice made by my wife, Jessica. Thank you for providing the emotional push to help me see this through. To my mentors outside of CGSC, LTG Blanck, BG Porr, COL McCaffrey, COL Maul, COL Volpe, and LTC Januszewicz, and to my many AMOPS friends, thank you for your listening and mentoring. To MG Peake, thank you for advising me to attend CGSC. Of course, you were correct about the many friends that one can make here. To my committee members, LTC Rosendahl, MAJ MacDonald and MAJ Leeson who spent a lot of effort "focusing me" during this project, thank you for your time and understanding during my many other time demands.

TABLE OF CONTENTS

APPROVAL PAGE	ii
ABSTRACT	iii
ACKNOWLEDGMENTS	iv
LIST OF ILLUSTRATIONS.....	vi
LIST OF ABBREVIATIONS.....	vii
CHAPTER	
ONE. INTRODUCTION.....	1
TWO. MISSION ANALYSIS OF THE MILITARY DECISION MAKING PROCESS	13
THREE. ANALYSIS OF CAPABILITIES AND ESTABLISHED COURSES OF ACTION	30
FOUR. COURSE OF ACTION ANALYSIS	45
FIVE. COURSE OF ACTION MATRIX AND COURSE OF ACTION RECOMMENDATION.....	49
SIX. FUTURE RESEARCH FROM THIS THESIS	53
ILLUSTRATIONS.....	58
BIBLIOGRAPHY	68
INITIAL DISTRIBUTION LIST	73

ILLUSTRATIONS

Figure	Page
1. Forward Surgical Team Layout in one General Purpose Large Tent	59
2. The Forward Surgical Platform	60
3. The Forward Surgical Platform	61
4. Power Distribution for an FST	62
5. Mobile Medical Platform in a Sling-Load Configuration	63
6. The Deployment Rapid Assembly Surgical Hospital	64
7. The Advanced Surgical Suite for Trauma Casualties	65
8. The Airtransportable Trauma Trailer Configuration of a Mobile Medical Platform	66

Table

1. Course of Action Matrix for "Housing" an FST	67
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ACRONYMS

AAR	After Action Report
AAT	Airmobile Trauma Trailer
ARTEP	Army Training and Evaluation Program
ASSTC	Advanced Surgical Suite for Trauma Casualties
BAS	Battalion Aid Station
COA	Course of Action
CSH	Combat Support Hospital
CSS	Combat Service Support
DART	Disaster Area Relief Team
DRASH	Deployable Rapid Assembly Surgical Hospital
FST	Forward Surgical Team
GP	General Purpose
HSS	Health Services Support
JRTC	Joint Readiness Training Center
MASH	Mobile Army Surgical Hospital
MDMP	Military Decision Making Process
MEDCOM	Medical Command
MKT	Mobile Kitchen Trailer
NCA	National Command Authorities
OOTW	Operations Other Than War
OR	Operating Room
ORT	Operating Room Trailer

PPT

Pre-op/Post-op Trailer

QRF

Quick Reaction Force

CHAPTER ONE

INTRODUCTION

I believe that the mission of the U.S. Army is to deter aggression. If this deterrence should fail, then the enemy must be closed with and destroyed. In the recent past, our Army has had many other non-traditional roles. Peacekeeping (with or without significant firepower) has many forms, and detailed rules of engagement. Traditional role or not, when troops are deployed, medical support must follow. In the non-traditional role of a humanitarian mission, medical care is the primary focus. Therefore, there is an increasing demand for medical support. This thesis tried to address one part of the medical support capability, its mobility. Additionally, this thesis proposed a new method of making the medical support more mobile.

Understanding the Problem

1. Establishing the Future Need for More Mobility

The Army's current operations doctrine addresses what the battlefield may look like, and what the Army must do to be the victor. The Army Field Manual 100-5, Operations, purpose is to communicate the doctrine, and lay the foundation for all to follow. Maneuver, is one of the principles of war. Maneuver is essential for: generating combat power, sustaining the initiative, and exploiting success. The result is that maneuver can reduce vulnerability.¹ Therefore, maneuver may be the most important element of our Army doctrine.

Recognizing that most of the Army's movement is not by foot, but by vehicle is the first step in recognizing the need to keep the most modernized vehicles available to

our soldiers. Moving faster than the enemy is a function of both leadership decision and the capacity of the combat vehicle(s). This is the concept of agility. Agility is needed for both offensive and defensive operations.² Agility can reduce vulnerability, thus saving soldiers lives.

The need for agility includes not only combat units but support units as well. Medical units are in direct support of (combat) maneuver battalions and brigades. These medical units will remain under direct command and control of these combat units, as the Army transitions into Force XXI.³ Other support units will be under more control from their specific support companies from the support battalions.⁴ This should give the non-military reader a sense of how closely the medical support units work with their maneuver units. Maneuver units have a unique bond with their medical support. It would seem logical that as the maneuver unit vehicles modernize, so would the medical support vehicles. Unfortunately, this is not the case.

Modernization of the medical vehicles is mainly the responsibility of the U.S. Army Medical Command (MEDCOM). Indeed, there are research and development sections that are dedicated to this goal.⁵ However, modernization of combat units may prompt modernization of support units, there is no direct link.

Maneuver (combat) units have a finite support (supply) capacity. As stated earlier, agility is important. However, a "head" maneuver unit can not move farther than allowed by its "tail." This tail is the mobility of the support units. Agility from a combat unit to gain an objective must be synchronized with the abilities of essential support units to closely follow. Frustration in the commander can occur if an objective must be abandoned (or a plan altered) because the support units can not reach the objective as fast

as required. Thus, synchronization can be one of the most difficult imperatives to achieve. The commander, staff planners, and operators must "arrange battlefield activities" in time, space, and purpose, in order to bring the maximum relative combat power at the decisive point.⁶ This synchronization could be less difficult if all the support unit vehicles were as fast as the tanks and fighting vehicles of the maneuver units, but this is not the case.

The medics in support of mechanized armor, infantry, cavalry, and field artillery units still use a mechanized ambulance that was first fielded before the Vietnam War. Yet, efforts to change to a faster (and more modern) track vehicle have been canceled due to budget cuts.⁷ Air Assault and "motorized" Light divisions must rely on outdated tents and metal chests for holding medical supplies. Clearly, constraints are being placed on the modernization of medical vehicles and/or medical work areas, and/or medical supply holding capacity, are affecting more than just the medical units.

Has medical support failed to support the maneuver commander? No, not as yet. However, the Government Accounting Officer expressed a belief that "if the Persian Gulf War had lasted longer than it did, field hospitals and medical staff would not have been able to cope with the expected flood of wounded."⁸ Yet, what is the prediction for the near future? Again, one may find an answer in the present doctrine. Here is a list of Combat Imperatives:

- Ensure unity of effort
- Anticipate events on the battlefield
- Concentrate combat against the enemy vulnerabilities
- Designate, sustain, and shift the main effort
- Press the fight
- Move hard, strike fast, and finish rapidly
- Use terrain, weather, deception, and OPSEC

Conserve (fighting) strength for decisive action
Combined arms and sister services to complement and reinforce
Understand the effects of battle on soldiers, units, and leaders⁹

“Move hard, and “finish rapidly” once again underscores the need for mobility.

“Strike fast” with “combined arms” will make the next battlefield more lethal than ever before. The U.S. Army believes that their enemy and not themselves will feel this lethality. However, with more rapid action (maneuver) comes more confusion, more crowding, while using very lethal weapons. In other words, the U.S. Army could be its own worse enemy. Clearly, the medical support will be tasked to take care of more wounded. Thus the medical support capability will not only depend on its ability to keep up, but also on its ability to have the appropriate medical supplies readily accessible.

In the traditional combat support role, the medical support must keep up, in order to perform its motto “to conserve fighting strength.”¹⁰ Yet, it has been reported that the American people believe that modern technology, and modern medicine equate to a death-free (combat) environment.¹¹ Clearly, medical capabilities must expand in the area of mobility, and in medical personnel and supply transport (hauling) capacity, or the American people must be informed of why it was not done.

2. The Future Expectations of the Military in a Non-Traditional Role

Most of the missions of the U.S. Army have been in Operations Other War (OOTW). “In OOTW, the Army seeks to create, set, or control conditions to achieve the military commander’s end state within the strategic end state articulated by the National Command Authorities (NCA).”¹² The Army’s capabilities to succeed in leveraging the environment consistent with the national policy, must be synchronized

with joint planning.¹³ As mentioned before, Army synchronization is difficult, and joint synchronization is even more difficult. War is the traditional military role most associated with combat operations. This is different from conflict, in which the role of the military is military persuasion after a failed diplomatic influence.¹⁴ Peacetime may often use a non-traditional military role where the U.S. can influence world events through: disaster relief, nation assistance, security assistance, counter-drug operations, arms control, treaty verification, support to domestic civil authorities, and peacekeeping. Both conflict and peacekeeping activities are classified as OOTW missions.¹⁵

OOTW may well represent job security for the U.S. Army as more of these missions are to be expected. Of course, if the maneuver units have an OOTW mission, then so will their medical support units. However, some of the above mentioned peacekeeping activities have medical care as their focus. Disaster relief is something that can not be planned for, and medical mobility is a key factor in reaching the area in order to save lives. Since the Army is often the service called upon to perform disaster relief missions, a rapidly deployable medical package should be investigated. A "new" mobile medical platform could be a valuable asset.

3. Future Medical Modernization on a Limited Military Budget

In several speeches made to the CGSC class of 98-99 by our present military, most of them included a reference to the limited military budget. The Army Material Command, did not meet all its force modernization funding requirements, and that an increase in the force modernization funding is uncertain. Not only did the military budget fall behind the rate of inflation, many missions were added without the additional

funding source.¹⁶ Given the constraints in the Army budget for force modernization, cost considerations will be play a big factor in fielding any new piece of equipment.

4. Balancing the Demand for Increased Medical Support Forward Versus Relying on Evacuation to Hospital Facilities

The health service support planner and operator should apply the following rules, in order of precedence.¹⁷

1. Maintain medical presence with the soldier
2. Maintain the health of the command
3. Save lives
4. Clear the battlefield
5. Provide state-of-the-art medical care
6. Return soldiers to duty as early as possible

These rules are intended to guide the health service support planner to resolve system conflicts encountered in coordinating health service support (HSS) operations. Medical care has been defined as having the injured soldier receive prompt resuscitation, stabilization, and maintenance of this stabilization during evacuation.¹⁸ The better the stabilization, the greater distance the patient can be evacuated (as time is less of a factor.) Herein lies the balance between placing more HSS forward (possibly in harms way) versus relying more on ground and/or air evacuation of injured soldiers. (Forward) stabilization versus evacuation means a greater reliance on a forward medical presence, in order to compensate for a decrease in evacuation back to more definitive (hospital) care. A decrease in evacuation ability can be due to limitations imposed by: the battlefield combat, weather, ambulance maintenance requirements, the rate of injury, and

other factors. The number of ground and air ambulances will stay the same in the Army's future FORCE XXI.¹⁹ If the evacuation capability can not improve, then stabilization will have to improve.

To increase the capability of stabilization on the battlefield, HSS planners can preposition medical units and/or medical supplies forward. One of the ways to preposition medical assets forward on the battlefield is by deploying the Forward Surgical Team (FST). Surgical care has traditionally been assigned to a Corps or higher echelon unit. The FST can provide a limited surgical capability down to the maneuver brigade. (A more detailed description of the FST will be discussed later in this thesis.) The FST should be able to match the mobility of the supported unit. Currently, many FST units rely on cumbersome tents and bulky medical supply chests. Finding an improved tent or vehicle to house the FST and minimize the need for bulky medical chest would improve its mobility. Improvement in the mobility of the FST's should be a worthwhile pursuit.

Many bulky medical chests also hamper the mobility of the battalion aid station. In mechanized (heavy) maneuver units, there is relatively more room to transport these medical chests than in non-mechanized (light) maneuver units. In either unit, these chests must be unpacked and require additional room to be opened and operational. Later, these chests must be repacked and uploaded in order to move again. Decreasing the need to move these chests or not use them at all would make any battalion aid station more mobile. However, the capacity to transport at least the minimum amount of medical supplies must not be decreased.

The Problem

It would appear that the Army of the near future will rely more heavily on agility (maneuverability) at all echelons. These maneuver units have become more mobile as their vehicles have been modernized. Medical units in support of maneuver units have not been able to upgrade their vehicles or their medical supply chests. This makes the medical support units even less mobile relative to their maneuver units. There does not appear to be adequate funding to rectify this problem for these medical units in the near future. It also appears that medical units will be even in more demand as OOTW missions increase and focus on medical aid. Therefore, a short-term solution would be convert (or modify) a piece of existing Army equipment, which is available and relatively inexpensive to acquire.

The Thesis Statement

It is feasible to convert the existing Army Mobile Kitchen Trailer (MKT) into a mobile medical platform. This proposal could not permanently alter the MKT should the experiment fail. Additionally, the modifications must be of minimal costs.

Secondary Questions

Secondary questions would include, but not limited to:

Define what is a feasible adaptation,

Define what type of comparative analysis should be used,

Delineate which types of other proposals should this conversion be compared to.

Assumptions

A many dictionary definitions of feasible include the words capable and suitable. Given the above mention parameters in part II (the problem), this thesis defines suitable as: requiring minimal cost, minimal time (and work) to adapt any piece of equipment. Capable will mean that our MKT conversion must meet or exceed the established medical mission capabilities.

Any researcher should have some experience with a feasibility study prior to conducting new research. Additionally, the reader of the research should also share some common knowledge of the chosen feasibility criteria.

After some preliminary research, this thesis question will be compared to the existing Army equipment as it is written on the modified table of organization and equipment (MTOE). In the adaptation for a FST, additional comparisons will be made against the Deployable Rapid Assembly Surgical Hospital (DRASH), and the Advanced Surgical Suite for Trauma Casualties (ASSTC). (A more detailed description of these systems and why they were chosen for comparison will be presented later in this thesis.)

Limitations

This thesis has undergone initial field testing at the National Training Center in the mobile emergency room configuration called the Air-transportable Trauma Trailer.²⁰ The other configurations have not been field tested to date. It is important not to permanently alter the MKT, should the experiments fail. Therefore, alterations must be attached to the stable frame of the MKT in a non-permanent fashion. This should not

decrease the effectiveness of the adaptations. Certainly further field testing would be extremely helpful in determining the suitability of this MKT conversion.

The weight of the required medical equipment has been estimated from charts taken from Army Field Manuals. It would obviously be more accurate to actually weigh the modified MKT with all its medical equipment. It is believed that the estimated weight is fairly accurate.

Research Methodology

Of the various decision processes used in business, this thesis chose the Military Decision Making Process (MDMP). There were a number of reasons for this decision:

1. The MDMP was the familiar to the author.
2. The audience of this thesis should be military personnel who should be familiar with the MDMP.
3. The MDMP was chosen for its ability to emphasize certain criteria throughout the research process.
4. More importantly, the MDMP uses a numeric ranking system of all options in order to minimize subjective bias before reaching a conclusion.
5. The MDMP is used to make time critical military decisions, and therefore has a proven success record.

The application of the MDMP is best outlined in Army Field Manual 101-5.²¹

This thesis will divide the project into four more chapters, which is consistent with the phases of the MDMP. The first chapter (or phase) is the "mission analysis." During this phase, current doctrine is reviewed in more depth, along with: Army training

standards, lessons learned reports, military medical articles, and after action reports. This will help to project the requirements for medical support to the maneuver units. The next chapter is the "analysis of capabilities" (also called relative power), and the "generation of options." This chapter will examine the capabilities of the existing and proposed solutions to making medical support more mobile. Each proposal will be treated as an option called a course of action (COA) to be compared later. The next chapter is the COA analysis whereby each COA is examined in various situations, commonly called "wargaming." This will also help to determine the primary and secondary criteria for comparison. The last chapter involving the MDMP is the COA comparison and COA recommendation. Here each COA is graded against criteria established in the previous chapter. A numerical score is given, and the proposal (COA) with the highest score becomes the recommended course of action. Although there is a degree of subjective input, the MDMP attempts to minimize any bias through a numerical rating.

Significance of the Study

This study will address possible shortfalls in the medical support of maneuver units in the near future, and it proposes a "feasible" short-term solution to this problem (at a relatively low cost).

ii. ¹U.S. Army, FM 100-5, Operations, (Washington: Department of the Army, 1986),

²FM 100-5 (1986), 15.

³U.S. Army, FORCE XXI Division Concept for Combat Service Support Operations (Final Draft) (Washington: Department of the Army, 15 May 1998), 2-1.

⁴FORCE XXI - CSS (1998), 2-2.

⁵U.S. Army, Directory of the Army Medical Command, (Fort Sam Houston, May 1997)

⁶FM 100-5 (1986), 17.

⁷Todd Silver, "Blackhawk: "Next Generation" in Care," U.S. Medicine (Dec 1998), 3.

⁸J. Lancaster, "GAO study says Army dodged medical bullet," Washington Post (Feb. 6, 1992) A3.

⁹FM 100-5 (1986), 23.

¹⁰U.S. Army, FM 8-55, Planning for Health Service Support (Washington: Department of the Army, 1994), 1-1.

¹¹Edward K Jeffer, "Medical Triage in the Post-Cold War Era," Military Medicine, vol 159 (Association of Military Surgeons of U.S., (May 1994) 389.

¹²U.S. Army, FM 100-7, Decisive Force: The Army in Theater Operations (Washington: Department of the Army, 1995), 1-1.

¹³FM 100-7 (1995), 1-2.

¹⁴FM 8-55 (1994), 1-1.

¹⁵FM 8-55 (1984), 1-1.

¹⁶Todd Dombroski, Personal Class Notes from CGSC (1998-1999).

¹⁷FM 8-55 (1994), 1-2.

¹⁸FM 8-55 (1994), 1-3.

¹⁹FORCE XXI – CSS (1998) 2-3.

²⁰Todd Dombroski, Medical Support, After Action Report for 3rd BDE, 24th ID, Fort Irwin, CA, April 1993.

²¹U.S. Army, FM 101-5, Staff Organization and Operations, (Washington: Department of the Army, May 1997).

CHAPTER TWO

MISSION ANALYSIS OF THE MILITARY DECISION MAKING PROCESS

Introduction

This chapter of the thesis briefly reviews the current doctrine in both the maneuver and medical areas in order to establish the requirements of a battalion aid station (BAS), and a Forward Surgical Team (FST). Realizing that doctrine is a foundation, and may not always be current, other sources of information were also reviewed. These were ARTEP's (Army Training and Evaluation Program), a review of medical lessons learned from Operation Just Cause, and Operation Desert Storm, several articles on military topics, and more recent AAR's (After Action Reports) personally conducted from NTC (National Training Center) and JRTC (Joint Readiness Training Center). These additional sources should help make the requirements for medical support as up to date as possible.

Current requirements are very helpful, but the Army is ever changing. The next proposed change is FORCE XXI. The changes noted in FORCE XXI, which may affect medical support will also be briefly reviewed.

A Brief Review of Current Maneuver Doctrine as it Applies to Medical Support

Having reviewed FM 100-5 in the first chapter, this section looked at other applicable maneuver Field Manuals. Starting at the maneuver battalion (mechanized) level, Army Field Manual 71-2 was reviewed. It stated that mobility (or rapid movement) is one of the battalion's main capabilities. Not surprisingly, any restrictions of mobility, due to restricted terrain or lack of fuel, was listed as its main limitation.¹ FM

71-2 lists five basic tenets of successful operations: initiative, agility, depth, synchronization, and versatility. These tenets are addressed for both combat and OOTW missions.

The application of these five tenets can be applied to medical support. The tenet of initiative is balanced against synchronization. Both of these tenets depend on agility. As in the first chapter, agility is key. Versatility can be very important tenet of medical support. Versatility is a benefit from cross-training, and/or having some redundancy in the medical personnel. Versatility can also apply to having some redundancy in medical supplies. The ability to obtain surplus medical supplies, and having an additional vehicle attached to the battalion aid station (BAS), allowed one BAS the ability to support an entire maneuver brigade upon its initial entry in the Gulf War.² Having enough medical supplies for the supported unit is not the only factor, now enemy prisoners of war must be taken into consideration.³ Medical support versatility can be more complicated if the mission changes from combat to peacekeeping in a relatively short time.⁴

FM 71-2 states "the medical platoon's survivability and mobility are increased by the use of armored evacuation vehicles, and an armored aid station."⁵ M577 is the designator for this armored aid station, and the M113 is the designator for the armored ambulance. However, the medical supplies for the BAS are carried inside the M577 vehicle. All of its medical chests have to be unpacked in order to provide enough room to work on one side of two wounded soldiers. Surprisingly, the internal configuration of this armored ambulance is not designed to properly support two injured soldiers on litters. The M577 has a tent extension, which is commonly set up in the field to provide some protection from the weather, but it offers no protection from indirect fire. Essentially, the

patients in a mechanized aid station have no more protection than the patients in the small tent of a light (non-mechanized) battalion aid station. However, the M577 has the potential for carrying more medical supplies.

FM 7-20 covers the Light Infantry Battalion Task Force.⁶ In the Light Infantry, the BAS consists of a general purpose small tent. This allows just enough room for one litter patient. All the BAS medical supplies are in chests that are transported on HUMWV's (jeeps) with limited space. The Light Infantry Battalion must also be mobile, and to do this, it sacrifices some of its ability to transport supplies.⁷ The BAS for a light infantry battalion is at a disadvantage for both mobility and medical supply availability when compared to a heavy battalion.

The BAS from both the light and heavy infantry battalions utilized "split operations."⁸ This is a technique where the BAS splits into two smaller BAS units. It is designed to place one of the smaller BAS units more forward to decrease the time the wounded soldier receives medical stabilization. Split operations would hopefully make the smaller BAS units harder to destroy, as they would be two smaller targets. The destruction of one would not obliterate all the medical support to the battalion. This strategy would appear to add versatility. However, half of a BAS can be twice as likely to get overwhelmed in a mass casualty. This can lead to a decrease in total medical support. One review article pointed out that died of wound rates were more related to medic-level first aid, than by treatment from a higher echelon medical officer.⁹ Herein, lies the trade-off between the less vulnerable split BAS, and the full BAS in a mass casualty situation

FM 71-3 covers the next higher echelon of maneuver units: the armored and mechanized brigade. Included in this field manual are the same five tenets for both combat and OOTW.¹⁰ Again, the capabilities and limitations are the same. The brigade receives its medical augmentation from the attached support battalion. Here the Brigade Surgeon is responsible for the health services plan.¹¹ However, the Brigade Surgeon has no command authority over any of the medical assets in the brigade. This is the same for Cavalry Operations.¹² FM 71-3 states "the medical company operates from mobile medical treatment facilities. These mobile medical treatment facilities feature built-in equipment."¹³ FM 71-3 does not delineate how mobile these facilities are (in regards to time or distance.) Nor does it describe what is "built-in equipment." In the 12 years of the author's experience, there is not such a thing as an Army issue form of built-in equipment. All of the built-in equipment has been non-standard, based on ideas of medical personnel in that unit. It would appear that the "built-in equipment" concept that is quoted in a maneuver field manual, may not be accurate.

Medical doctrine for the medical support of a combat brigade states that treatment teams should be deployed forward. This team usually consists of medics (with or without a medical officer) in an M577 in the heavy brigade (or wheeled vehicle in the light brigade).¹⁴ These treatment teams come from the forward support medical company. The reason for these treatment teams is to reassess wounded soldiers at an ambulance exchange point, and/or replace a BAS if the BAS is destroyed. The use of treatment teams comes at a cost of decreasing the medical personnel assets of the medical company. Since these treatment teams are smaller in vehicles and personnel than a BAS, should they be responsible for replacing a BAS? A treatment team could make up some

of its BAS shortfalls, if a better vehicle with additional medical transport capability could be fielded. The forward support medical company will also order its ambulances to initially travel with the supported BAS. This is the concept of "front loading" whereby these ambulances are ready for the first group of casualties that require ground evacuation to the forward support medical company.

Comparisons between the above mentioned medical support and the medical support for light infantry, airborne, and air assault units were made as outlined in FM 63-2-1.¹⁵ Here again the medical support units must maintain their contact with the maneuver units, by maintaining mobility. Unfortunately, these units do not have transportation capacity for medical supplies that is present in the mechanized units. Mechanized units have armored vehicles which can carry more personnel than the Army's HMMWV (jeep). There are also more wheeled (truck) vehicles that are available to the heavy brigade. This means that there are less non-standard (non-ambulance) vehicles available for the movement of injured soldiers in a mass casualty situation.¹⁶ As a result of the above medical support difficulties, these light maneuver units have priority for air ambulance evacuation over heavy units.¹⁷ Unfortunately, the same number of UH-60 medical evacuation helicopters support a heavy brigade or a light brigade (which is 3).¹⁸ Problems may occur if air evacuation is not available due to weather or other restrictions. It would seem obvious that a piece of equipment that would provide additional medical supply hauling capability, and have built-in equipment to maintain mobility would be a highly valued.

FM 71-100 covers Division Operations. Here it is stated that "force projection has become our chief strategy, and the mission is to rapidly respond to worldwide

regional crises.¹⁹ This is mobility at its highest level. However, a division may lack many of the specific combat service support (CSS) elements, one of which is surgical support. This augmented is better outlined in FM 100-15 which covers Corps Operations.²⁰ Surgical capability in the form of a Combat Support Hospital and/or FST's, as well as medevac helicopters are attached from Corps. The Corps may assign additional surgical and medevac units if the Corp is not fully deployed. Otherwise, the Corps has a fixed number of medical assets.

The non-medical field manual which best delineates the functions of medical support may in fact be FM 100-10. It covers Combat Service Support at many echelons, which includes medical support. FM 100-10 restates many of the points made previously. It notes the increased potential for numerous global actions on a smaller regional scale.²¹ It reiterates the force projection model, and the need to operate around the globe, often on short notice.²² Again, this stresses the need for mobility. It also notes supporting the new "force projection Army" will require support personnel to work faster and smarter, by taking advantage of technology and all possible resources.²³ This may tend to support an idea to adapt a piece of equipment that is already in the Army supply system. In fact, it has a whole section on improvisation as a means to provide responsive support.²⁴

In summary, all maneuver units expect responsive medical support. As the doctrine is founded on mobility, it can be a challenge for these medical support units to physically keep pace, while hauling the necessary supplies and personnel.

A Brief Review of Current Medical Doctrine for Combat Service Support

FM 8-55 covers Planning for Health Service Support (HSS). It compliments, and further details much of what is written in FM 100-10. FM 100-10 reviews critical combat health support resources as the "rapid deployment of medical personnel and Class VIII (medical supplies), to include mobile medical treatment squads (from a battalion aid station) and forward surgical teams (FST's).²⁵ FM 8-55 addresses the analytical side of medical planning, and based on the most likely scenario, how many casualties may occur.²⁶ This can add some objective data to the subjective reasoning behind the placement of medical support personnel and supplies.

FM 100-10 discusses tactical considerations in combat health care. "Due to the destructive capabilities of modern weapons, a mass casualty situation will probably exceed the capacity of local medical units. Medical units must be flexible, and (be ready to) alter their normal operations to provide the greatest good for the greatest number. Key factors for effective mass casualty management are: on-site triage, emergency resuscitative care, early surgical intervention, reliable communications, and skillful evacuation by ground and air resources."²⁷ Being flexible can also be applied to nearby medical units, which could assist in a mass casualty if their mobility were adequate. Making medical support assets more mobile at all echelons, makes them more flexible.

There are field manuals, which deal specifically with early surgical intervention (FM 8-10-25) and evacuation operations (FM 8-10-6). FM 8-10-6 stresses the importance of proper stabilization prior to evacuation, without it, the patient may not survive the transportation.²⁸ FM 8-10-25 covers the Employment of Forward Surgical Teams. The FST is the answer to improving stabilization. Historically, 10-15 percent of

wounded soldiers require surgical intervention to control hemorrhage and provide stabilization sufficient for evacuation. Surgical capability as far forward as the brigade medical support company is required to reduce the mortality of these soldiers.²⁹ The newly designed FST may be called to augment other treatment units during OOTW missions. At the writing of this thesis, there were six fully functioning FST's on active duty.³⁰ This is not even one FST per division. Given that there are ten active duty divisions with three brigades each, and four separate brigades or cavalry regiments, it would take 34 FST's to fill the proposed requirement for combat operations. More FST's are being planned. If the number of FST's were increased to one per division, then the need to make that FST highly mobile between the three brigades would be a logical assumption (i.e. requirement.) As quoted from FM 8-10-25, "the forward surgical capability has become the Army's top priority in order to ensure this capability is as mobile as the supported unit."³¹

How mobile is an FST? According to FM 8-10-25, when fully uploaded in its six HMMWV (high mobility multipurpose wheeled vehicles), the FST requires one hour before it can receive patients.³² (This is based on setting up one large Army tent, and unloading the necessary equipment and supplies.) A combat health care planner may wonder if this is mobile enough. Given that there may only be one FST per division in the future, one would assume that the FST would be assigned to the main effort brigade. Unfortunately, the enemy forces do not always fight the main effort brigade as planned. The FST may need to be disestablished, uploaded, and transported to the brigade engaged in the main fight. Currently, there are no timelines for such a re-deployment. Perhaps, the FST should be more mobile.

The FST is dependent on the support battalion's medical company for food, water, fuel, security, communications, x-ray and lab services, air evacuation coordination, rigging for sling-load operations (slung under a helicopter), but most importantly it needs a back up generator.³³ It is also dependent on a combat support hospital for clean medical instruments and replacement personnel if operations last more than 48-72 full hours.³⁴ The FST could be mistakenly thought of as an independent medical support unit, but this is not true.

The maximum capacity of an FST is thirty surgeries in seventy-two hours.³⁵ Thirty surgeries for 30 critically wounded soldiers would be 1 percent of the average maneuver brigade's combat strength. Historically, of the soldiers wounded in action, 10 to 15 percent are critically wounded.³⁶ The number of expected critically wounded soldiers in a brigade on the offensive would be greater than thirty.³⁷ This also assumes that the one division FST is present to support this brigade. The purpose of this section is not to undermine the excellent care that a FST can provide, this thesis is only trying to point out limitations in the FST capabilities. A more detailed description of the FST equipment and personnel will be presented in chapter three of this thesis.

A brief review of FM 8-42 covering Combat Health Support in Stability Operations and Support Operations notes the same priorities for mobility, stabilization, and evacuation as those for OOTW missions. Stability and Support Operations (SASO) is the newer name for the peacekeeping half of OOTW missions. Additionally, it covers host nation support, possible rules of medical engagement, and host country customs and laws.³⁸ This field manual serves to note that medical support operations in the near future may likely be more complicated with rules, laws, and customs.

To summarize this section, mobility is very important to the medical support units, as much as their maneuver units. Unfortunately, only now is there a funded plan to field a more modern armored ambulance for the mechanized battalions/brigades.³⁹ As previously stated, the lack of mobility is more pronounced in the light infantry units, who currently have no upgrade plan. This is due to a lack of funding.⁴⁰ Mass casualty capability is dependent on flexibility. This is a function of the ability to quickly move in, set up, and transporting the proper medical supplies and personnel. If the number of personnel remains the same, then upgrades to the set up of a battalion or brigade medical unit will have to be made.

There is a priority being placed on the FST by the medical command. There still remains a great shortfall in the number of FST's per maneuver brigade. The lack of funding in this area could not be documented. According to one Combat Support Hospital (CSH) Commander, there are not enough surgeons in the Army to fill all the assignments of thirty-four FST's, and fill all the positions for surgeons in the CSH's.⁴¹ Unfortunately, the FST's dependency on other units, and its limited surgical capacity may have to be addressed commanders in the near future. (It will be addressed later in this thesis.)

A Brief Review of Lessons Learned Regarding Medical Support

Two documents were reviewed covering lessons learned regarding medical support operations at all echelons of care. The lessons learned were made more concise, and were listed only if they were applicable to this thesis.

The first document covered lessons learned from Operation "Just Cause."⁴² These lessons will be presented in no particular order. First, the use of a Forward Army Surgical Team (FAST) was a success. There was only one FAST in the area of operations, but it was deemed to be highly successful. Not only did it provide emergency surgical care, but it quickly made the transition to providing displaced civilian care. (The name FAST, was later shortened to its current name, FST.) Second, air evacuation with standard and non-standard ground ambulance evacuation was crucial. Third, the FAST medical equipment could not be safely dropped by parachute. Forth, each medical unit desired improved inter-medical unit communication, and/or better communication with air medical evacuation assets.

The next set of lessons learned come from Operation "Desert Storm."⁴³ First, the Mobile Army Surgical Hospitals (MASH) and the Combat Support Hospitals (CSH) were not mobile enough. They took days to set up, and much longer to tear down and move. Second, evacuation by ground ambulance was too far for the critically wounded soldiers. Third, calling for an air (medevac) ambulance took too many steps, and/or included too many clearances. Forth, the battle moved too fast for the brigade medical companies to completely set up. Fifth, medical supplies to the battalion aid stations were either too little or too much to carry and had to be discarded.

To summarize this section, the concept of the FST was proven. However, if the brigade medical companies can not set up properly, then some of the support to the FST may be lost. For greater distances, air evacuation is the preferred method, but it may require additional clearance and or better access to radio communications.

Current Articles

Even as the maneuver units upgrade their vehicles, this still may fall short of the expectations for force projection in the Army. Senator McCain has recently called for a fundamental restructuring of the Army (to make it more mobile.)⁴⁴ Senator McCain is a senior member of the Senate Armed Services Committee. General Reimer, as Chief of Staff of the Army, stated the need for more strategic mobility.⁴⁵ Increasing mobility is a goal, not an end state. Increasing mobility must fit into the unit mission, otherwise it is just an expensive feature.

Increase mobility without control is wasted. In one article covering medical support during Operation Desert Shield/Storm, stated that medical mission coordination was a problem until a central dispatch agency was formed (especially for air and ground evacuation.)⁴⁶ Another frustrating fact of medical evacuation is that the transport times have not changed since the Vietnam War.⁴⁷ One of the reasons may be that medical evacuation has been a low priority task for the staff of a maneuver brigade, and was not synchronized into the battle plan. A possible solution would be to assure that a medical support planner was present if the brigade surgeon was not available.⁴⁸ Another article highlighted the need to improve coordination between the forward support medical company, the forward support battalion, the S-3 brigade aviation planner, and the (air) medical evacuation team.⁴⁹ This article also discussed the ambiguity of who is the actual launch authority of the MEDEVAC (helicopters). Another article reiterates a theme from lessons learned section, that a dedicated medical evacuation frequency is necessary⁵⁰ (but it is rarely assigned by the brigade signal officer due to the few numbers of radio

frequencies that are authorized.) Clearly, evacuation is not an easy task, which may make stabilization more critical to the survival of the wounded soldier.

After Action Reviews (AAR's) and Army Training and Evaluation Programs (ARTEP's)

This thesis includes ARTEP standards for deployment of a medical support unit. As mentioned previously, the maximum set-up time for a FST is one hour. For the small tent and medical chests to be set up for a battalion aid station, the maximum time is 20 minutes.⁵¹ This was for a light infantry unit. One may ask could these times be improved with something other than a tent and chests?

One medical AAR from a rotation at the National Training Center, Fort Irwin, California, was reviewed.⁵² First, the Light Infantry Battalion and the Brigade Medical Company had trouble setting up their tents due to high winds, or rocky soil. In either case the problem was due the ground, either pounding the pegs into the ground, or having the pegs pull out due to high winds. Second, if the battalion aid station for the light infantry was killed, captured, or ran out of supplies, it was very difficult to bring in replacement equipment and/or personnel. This was due to the distance and/or the inability to transport bulky medical chests in a hurry.

Another medical AAR from a rotation at the Joint Readiness Training Center, Fort Polk, Louisiana, was reviewed.⁵³ Similar to the AAR from the NTC, setting up on the ground was a major problem. The site for the FST and the brigade medical company and one battalion aid station were on unlevel ground, and/or became flooded, and/or could not be set up due to low overhead trees, or fell over in the very saturated ground. This greatly affected all levels of medical care to one degree or another. This greatly

affected the set up time of these medical units. (See the regulation set up times as noted above.)

Review of the Near Future Trends by FORCE XXI

The new Army Division of the FORCE XXI will be only 250 personnel less of its 15,812 end strength. It will have eighty-four less fighting vehicles (in the heavy division), but the fighting vehicles remaining will be given enhanced capabilities.⁵⁴ On a command and control issue, the forward support battalion will gain the support assets of the maneuver battalions with the exception of the medical platoon.⁵⁵ This may signify the close relationship of the medical platoon to the maneuver commander. If mobility is key, then are any additional truck or ambulance assets planned for the medical platoon? The answer is no. Nor will there be any additional air ambulances attached (it is still fifteen UH-60 "Blackhawk" helicopters attached to a division.)⁵⁶ There may only be one FST per division and not per brigade. There does not seem to be a plan for improving the mobility capabilities of the medical support units at the division or lower echelon units. It would not seem too difficult to foresee this issue as a potential problem. The key is to realize that it may be a problem, and act soon. Finding shortfalls on the battlefield is never an appropriate time. This thesis was written just for this purpose.

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²⁴ FM 100-10, (1995), 1-5.

²⁵ FM 100-10, (1995), D-1.

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CHAPTER THREE

ANALYSIS OF CAPABILITIES AND ESTABLISH COURSES OF ACTION

Introduction

This chapter discusses the capabilities of the various "housing systems" from which medical care is dispensed. These "housing systems" will be defined as standard tents, or some tent-like framed structure. In the second chapter, requirements for medical support in the present and near future were discussed, and in this chapter the capabilities for medical support from various "housing systems" will be presented. It is a simple logistical equation that capabilities minus requirements equals mission surplus or mission shortfall. This thesis will discuss possible shortfalls in logistical requirements for each "housing system." However, each "housing system" must not have any medical "shortfalls" in its ability to provide adequate space for high quality health care.

This thesis will present the medical requirements for a Forward Surgical Team (FST). The basic Army General Purpose (GP) large tent will be the basic "housing system." This will be compared against the proposed "housing system" (i.e. the converted Army Mobile Kitchen Trailer) in its configuration for an FST. Two other "housing systems for the FST will also be compared. These different "housing systems" will be called COA's (Courses of Action) to the problem of how to better house an FST in the field.

Basic Medical Requirements of an FST

Using FM 8-10-25¹, the base medical requirements are:

Conduct continuous operations of urgent (initial) surgery up to 72 hours
Have two operating room (approved) tables set up at all times
Have 2 to 4 surgeons and 1 to 2 anesthesiologists (or CRNA's) available
Perform at least 30 surgical cases in 72 hours or less.
Perform emergency medical stabilization (as a prep for surgery)
Perform post operative care for 4 to 8 patients (prior to evacuation from the FST)
Deploy all equipment and personnel on one C-130 (cargo plane)(less vehicles)
Capable of 100% movement by helicopter sling-load operations
Set up to receive patients with one hour of arrival to the area of operations
Generate at least 5Kw of power from organic assets

Currently there are 20 personnel assigned to an FST²:

Commander (General Surgeon)
General Surgeons (two)
Orthopedic Surgeon
Critical Care Nurse (head nurse)
Nurse Anesthetists (two)
OR Nurse
Senior NCO of OR
NCO of OR
OR Specialist
Emergency treatment NCO
Emergency Medics (two)
Post-op Nurse
Practical Nurses (three)
Operations Officer (Medical Service Corps) and NCO

The FST is dependent upon the unit to which it is attached for the following:

Food
Water
Fuel (for generators and HMMWV's)
(Local) Security
Vehicle maintenance
(Radio) communications
Electrical (generator) backup
Rigging for sling-load operations
NBC decontamination
Security on movement

In the field, the FST is set up in a general purpose large tent (figure 1.) It would seem obvious that any new "housing system" which decreased the items in the

“dependency” category, while maintaining the base medical requirements, would be considered an improvement.

What are the Qualities (or Features) of Functional “Housing System” for the FST?

From the first two chapters of this thesis, there were many recurrent themes which highlighted possible problems for an FST in the field. These characteristics are in no particular order.

Mobility has been the main topic of this thesis thus far. Mobility for a “housing system” is defined as the ability to set up (establish), then tear down (disestablish), and pack (up load) in preparation for another movement. The ability is measured in time. Other factors which affect the time are durability of the system, and the number of steps and/or personnel it requires to establish, disestablish and up load. It is necessary to equate the number of steps and the number of personnel required for proper establishment of the “housing system” in order to provide a fair comparison. In other words, it may be hard to compare a ten minute establish time requiring twelve personnel, with a twenty minute establish time from six personnel. If twelve personnel are readily available then the quicker establish time is always desired. However, from personal experience, the proper number of personnel are not always available. (A possible solution for this comparison problem will be presented in chapter four.) From the standard noted in the first section of this chapter, the FST must be able to receive patients within one hour. Any “housing system” which takes longer than one hour would not meet the medical requirement. This “housing system” would be medically unfeasible.

Cost is another factor that was very prominent in chapter two. It is assumed that all the proper medical equipment would be purchased for any of the "housing systems." The initial price of the "housing system" would be added to the cost of any additional equipment required to meet the minimum medical standards. All costs will be calculated as new costs, (i.e. no old equipment.)

Floor space is calculated in square feet. Usually, more floor space is desirable. However, a larger "housing system" can adversely affect its cost, its mobility, and its other desirable characteristics.

Transportability is related to mobility. Transportability is defined as the ability to be carried by a number of methods, by the minimum number of transport (ground or air) vehicles. The smaller the "housing system" the less space it will require, which should make it easier to be moved by a more types of vehicles (often referred to as primary movers in the Army.) The ability to be transported under a helicopter in the sling load configuration is desirable. The Army has both the UH-60 helicopter and the CH-47 helicopter for sling load operations. Unfortunately, the UH-60 has an 8,000 to 10,000 pound weight restriction.³ So, being able to be sling loaded under a UH-60, would make that "housing system" very transportable.

Weather can directly, or indirectly affect the "housing system." High winds, rain, or snow can directly affect the "housing system" adversely. Inclement weather can indirectly result in local flooding. Ground that was too wet or too hard was the most indirect weather effect that troubled the medical personnel in establishing their tentage.

Unleveled ground can be due to rocks, tree roots, or divots in the ground under the "housing system." Many times these things can be removed. However, a level piece

of terrain is not always available. If the FST had to be established in a mountainous area, a 20 degree slope would be common. Given that the operating room tables can tilt, this should not affect on the patients. The medical equipment can not be leveled so easily, and can be adversely affected by the degree of slope.

Maintenance requirements for a tent are few. More sophisticated "housing systems" can have additional repair or associated equipment repair requirements.

Power requirements are not associated with an Army tent. More sophisticated "housing systems" can require generators or blowers in order for them to function properly.

Availability to field, is a term that directly relates to the time it takes from purchase to establishment in the field.

Ease of concealment relates to the ability to be concealed from enemy observation. Natural vegetation and man-made camouflage are commonly used. The larger the size, the harder it is to conceal would seem obvious. Overall height is more of a negative factor than floor space as noted in the AAR's of chapter two.

Environmental control is essentially the control of the temperature in the "housing system." Since the anesthesia can be adversely affected by extremes in temperature, control of the inside temperature is very desirable.

The General Purpose Tent for The FST

As noted in figure 1, the FST was first established in a General Purpose (GP) large tent. The GP large tent is twenty-five by forty-five feet resulting in 1,125 square

feet of floor space. It is sixteen feet tall along its center support beam. The canvas for this tent comes with a cotton liner to aid in reducing radiant heat from the sun.

There are some distinct advantages of a GP large tent "housing system" for an FST.⁴ The tent has a very low cost of only \$3,900 for a new tent. There are used tents in the Army inventory that could be obtained to save even more money on the initial costs. The other main advantage is its large floor space, just over 1,100 square feet.

There are some apparent disadvantages of a GP large tent "housing system" for an FST⁵ as listed below:

- No environmental control (i.e. no air conditioning or heating with this tent)
- External environmental controls are inefficient due to canvas, as compared to other (modern) materials
- High temperatures can cause malfunction of anesthesia machines, ventilators or defibrillators
- Full set-up can take from 1 to 3 hours (tent set-up, then medical equipment set-up)
- Requires its own trailer for hauling
- Requires a large, flat area of ground with good drainage and no overhead vegetation against its center support beam

The Forward Surgical Platform (Two Adapted MKT's)

The "housing system" proposed in this thesis is the conversion (or non-permanently modified) of an Army Mobile Kitchen Trailer (MKT) into a Forward Surgical Platform (FSP). This will require two MKT's, which have been stripped of all the cooking shelves and burners. One MKT will be adapted into the operating room trailer (ORT), and one MKT will be the pre-op/post-op trailer (PPT). (See figures 2 and 3 which are drawn to scale.) These two modified MKT's would be pushed together (end-to-end) to form the FSP. The canvas covering (which is pre-attached to the pop-up roof) has been cut away, so that the interior can be viewed in figure 2.

There are four sets of stairs which are hooked onto the corners of the platform (see overhead view figure 3.) The modifications are as follows for the ORT:

1. Buy four litter racks (standard Army approved racks) which will hold one litter each
2. Build a wood frame to support the litter racks (using 4x4 inch wood beams)
3. Secure the oxygen concentrators* and ventilator* to the floor
4. Secure storage chests* to the frames of the oxygen concentrators* and ventilator*.
5. Build a wood frame for a gravity sink (using two-5 gal cans. Shower head, and plastic sink)

*These are a standard issue to the FST, resulting in NO additional charge.

Cost of the FSP

The cost of the litter racks are \$300 each (\$1,200 total).⁶
Wood frame fabrication for the sink and litter frames may cost \$800.⁷
Two new Mobile Kitchen Trailers ($\$23,000 \times 2 = 46,000$).⁸
Four - 3Kw generators ($\$3200 \times 4 = 12,800$).⁹
Two heater fan units ($\$200 \times 2 = 400$).¹⁰
Total = \$ 61,200

A new 5Kw generator for a standard FST set-up is \$13,800,¹¹ which is almost one forth of the costs of a new FSP set up. The remainder of the equipment would have to be purchased buy every set-up regardless of the "housing system."

The basic "housing system" for an FST is the GP large tent. It has just over 1,100 square feet of work area. This tent is divided into the surgery area with two operating tables, a recovery area with eight litters, and a triage area with two litters¹² (figure 1). The minimum time in order to receive patients at the FST is one hour, (and it must have

two operating room tables.) Therefore, the proposed FSP would have to comply with this minimum set-up in order to be medically feasible (i.e. meet minimum medical requirements).

As noted in figure 2 and 3, both operating room tables are set up, and there are four recovery tables, but no triage tables. The triage tables could be placed under a canvas tarp, which is attached to the side of the MKT (like it can be done when the MKT is serving food.) Remember that triage litters have no monitoring equipment requirements, unlike the recovery beds. Therefore, the lack of one "officially designated" triage bed does not make the FSP medically unfeasible. One of the recovery (pre-op/post-op litters) could serve as initial triage (pre-op) litters (hence the name), which makes the FSP medically feasible.

Operating Room (OR) tables are the most time consuming to set-up, and the Operating Room Trailer (ORT) does away with this requirement. All that is required is to "unfold the MKT," and move the stair and temporary storage bins into place. This takes four personnel, ten minutes to accomplish.¹³ This makes the FSP a very mobile platform, at a very low cost (as shown above.)

Another positive factor of the FSP is that it takes up only 280 square feet. This smaller "footprint" would allow for it to be set-up in a smaller area, which an 1,100 square foot tent could not. The FST is still rather tall, at a height of eleven feet. Which is less than the GP large tent and the DRASH system. This would make overhead vegetation less of a problem. The FSP's small size is advantageous for concealment, but the smaller floor space still provides all the required room. One thinks of visual

concealment, but the 3Kw generators of the FSP are much more quiet, than the generators of the other housing systems.

The FSP is still essentially an MKT, and has been certified as transportable by all US Air Force aircraft. More importantly, it has been certified as transportable for sling-load operations under a Blackhawk (UH-60).¹⁴ It weighs 5,730 pounds empty, and two personnel can rig it in less than twenty minutes making it highly transportable.¹⁵

The FSP is not affected by rocky or flooded soil, as it stands two feet of above ground. No tent pegs are required. Additionally, its support "legs" can be shortened in order to level the FSP trailers (up to a twenty degree slope.)

The FSP is independent for generating its electrical requirements. This is only true if the surgical sink is modified, otherwise, two 3Kw generators would not be adequate (figure 4.) The FSP can carry two 3Kw generators and a five gallon fuel tank on the tongue of the trailer (figure 5) for each of its trailers.

The only maintenance requirement is an occasional lubrication of the roof support poles. It can be fielded new, or an existing MKT can be obtained through the Quartermaster Center and School.¹⁶ The FSP has ventilation vents and a fan to decrease the heat (which also doubles as a heater).

The FSP system appears to have some obvious advantages over the GP large tent. One of the disadvantages is that it can not be towed by the common HUMMWV (jeep). This is due to the weight and height of its tongue. The FSP can not house all the recovery litters and the ten additional personnel that are organic to the FST. Adding additional PPT's to the FSP would affect many of its advantageous characteristics.

The Deployable Rapid Assembly Surgical Hospital (DRASH)

This system is also known as the Deployable Rapid Assembly Shelter (DRASH). Of the seven FST's currently on active duty, four of them have the DRASH "housing system."¹⁷ If the DRASH system is the future of the FST, why continue with the FSP proposal? There are cost, maintenance, and set-up issues, for which the FSP may have a better solution.

The recently developed DRASH "housing system" (noted in figure 6), has a ground surface area of just over 2,500 square feet (1,250 square feet per each tent), this is over double the size of a GP large tent. It is lower in height than the GP large (thirteen feet high), and is made from a space-age fabric which makes it easier to heat or cool the interior. It has aluminum alloy poles for an external frame. It is reported that four personnel can set up one tent in fifteen minutes (there are two large and one small connecting tent.) Total set-up time in fair weather is thirty plus minutes. It has its own heating/cooling system (which requires a 15Kw generator), all of which fits neatly on one long trailer. The DRASH has its own flooring, made of the same fabric, that connects to the tent. The pressure generated by the air circulating from the heating/cooling system and the flooring system. This provides an overpressure to the DRASH "housing system." Overpressure will keep air blowing out, and reportedly makes the inside safe from a chemical or biological attack, (provided no one is entering or exiting at the time of the attack.) The DRASH is transportable on all US Air Force aircraft, and it can be pulled by a HUMMWV (jeep), but is not currently approved for sling-load operations under a UH-119 (Blackhawk) helicopter. The DRASH "housing system" is medically feasible, as it meets all of the requirements for an FST as listed above, and it costs \$152,000.¹⁸

Positive comparisons will be discussed based on the list used on the FSP. The mobility of the DRASH is adequate. It requires good weather to establish it in the specified time. It is more complicated to set up, and it is more delicate with its numerous aluminum poles. A recent after action review¹⁹ revealed some set-up problems. Breaking one tent pole, compromises the tent volume significantly, and poles were broken on several occasions.

The DRASH is not certified to be sling loaded under a UH-60, this decreases its transportability.

It cost considerably more than a tent or MKT. It does not use canvas, the DRASH has a polymer fabric. It also adds a generator to its costs.

The DRASH has great floor space, but its rounded corners and rounded sides cut down on some of the usable space, (but its 2,500 square feet make this point trivial.)

The DRASH cannot repel standing water (if the ground is saturated). Its floor must be attached to its walls, in order to obtain better environmental controls. This is difficult on rough ground.

The DRASH has maintenance problems other than breaking its poles. The DRASH generator is too heavy for its trailer, which caused the tongue of the trailer to break in two on several occasions.²⁰ The 15Kw generator consumed a lot of fuel, which was not always available when the FST was deployed in an isolated area (away from the forward support medical company).

The DRASH is larger in floor space, but it appears to be easier to conceal than the GP large tent given a center height of thirteen feet. It is available to be fielded, but it is not on the military (or federal) equipment list.²¹

The DRASH environmental control seems to work very well. However, when the air conditioning was running, the 15Kw generator did not meet the electrical needs of the medical equipment, and the organic 5Kw generator was needed.²²

The DRASH system is a good system with superb floor space and environment control.

The Advanced Surgical Suite for Trauma Casualties (ASSTC)

The ASSTC was invented by Dr. William Wiessmann. Dr. Wiessmann is a retired Army physician. It has undergone two phases of testing. Currently, the U.S. Army is not considering the purchase of the ASSTC, but the U.S. Marines are considering it under the name of "Multipurpose Health Services Facility."²³ The Marines are considering it to replace the GP small tent of the battalion aid station, and as a portable operating suite to use after the initial (beach) assault.²⁴ It is very transportable (by aircraft, by sling-load, and it can even be towed by a HUMMWV (figure 7). The manufacturer stated that their fabric is even more insulating than the fabric used by the DRASH. Its poles are graphite, which are very difficult to break. However, it takes eight people, twenty minutes to set up one ASSTC under good weather on firm, level ground. Its thirty foot diameter, provides 700 square feet of floor space (or 1,400 if two ASSTC's are used) Even if four poles were somehow broken, the ASSTC would still be functional unlike the DRASH.²⁵ Clearly, the manufacturer of the ASSTC system views the DRASH as its competition. Unfortunately, two ASSTC units are required to fulfill the two operating table requirement, thus keeping it medically feasible. Each ASSTC costs \$200,000 each (for the two required) would be \$400,000.

Regarding mobility, the ASSTC is highly mobile as one unit. However, two are required. It has more durable, but a more intricate pole-frame. This requires more people, and more training. It also has a very limited storage capacity, as seen in the small drawer-chests that are pulled out during its set up (figure 7.) The amount of storage space was not available. More storage would have to accompany the ASSTC, which would decrease its mobility.

The costs for two ASSTC's make it a very expensive option. The current availability is zero, but one can be built for the purchase price. The ASSTC is not on the federal equipment list (Fedlog).

Two ASSTC's provides more floor space than a GP large tent, but its dome shape makes much of its floor space unusable. The GP large tent has five-foot vertical walls, which allow all of its floor space to be usable.

Two ASSTC's would require two helicopters for sling load operations. Its weight is low enough for a UH-60 to lift it.

The ASSTC has very similar power-generator requirements (15Kw) and thus has increased maintenance requirements.²⁶ Two large 15Kw generators must be fueled, and extra fuel can be difficult to procure if the FST is split away from its medical support company.

The ASSTC's heater and air conditioner are one unit (less bulky). This heater/cooler system is also reported to provide a better overpressure than the DRASH.²⁷ (This overpressure feature relies on no one entering or leaving the ASSTC, or the overpressure would be temporarily lost.)

The ASSTC is the easiest to conceal, given its relatively small footprint and its low height of ten feet.

Summary

The characteristics of each "housing system" were presented. Comparisons were made between the "housing systems" as well. Probable shortfalls were noted in each "housing system" as it related to the requirements minus the capabilities. Further ranking of these characteristics will be presented in the next chapter. Since all these "housing systems" represent a choice on which to use, each system will now be refer to as a course of action (COA) to keep the terminology consistent with the military decision making process.

¹U.S. Army, FM 8-10-25, Employment of Forward Surgical Teams, (Washington: Department of the Army, Nov. 1996) 2-1.

²FM 8-10-25, (1996) 2-3.

³U.S. Army, FM 55-450-4, Sling Load Operations, (Washington: Department of the Army, Aug. 1982) 2-49.7.

⁴Fedlog, a computer listing of Army Equipment and Pricing (Apr. 1999).

⁵Division Surgeon's Office, 25th ID, personal communication, Nov. 1998.

⁶Fedlog , (Apr. 1999).

⁷Fort Leavenworth DPW, personal communication.

⁸Fedlog, 1999.

⁹Fedlog, 1999.

¹⁰Fedlog, 1999.

¹¹Fedlog, 1999.

¹²FM 8-10-25, (1996) 4-9.

¹³Todd Dombroski, After Action Review (medical) for 3rd BDE of the 24th ID at NTC, (Apr. 1993) 3.

¹⁴FM 55-450-4, (1982) 2-49.7.

¹⁵FM 55-450-4 (1982) 2-49.5.

¹⁶www.Quartemaster.army.mil (804) 734-3296.

¹⁷CPT Shahbaz, U.S. Army Medical Department Board, Test Division, personal communication, Mar. 1999.

¹⁸www.DHS Systems LLC.com.

¹⁹Joanne McGovern, AAR on the use of DRASH by the 67th FST, (1997).

²⁰McGovern, (1997).

²¹Fedlog, (1999).

²²McGovern, (1997).

²³www. Asstc.com.

²⁴Ed Howze, personal communication, (Mar. 1999).

²⁵Ed Howze, (1999).

²⁶Ed Howze, (1999).

²⁷Ed Howze, (1999).

CHAPTER FOUR

COURSE OF ACTION ANALYSIS

Introduction

In keeping with the MDMP outlined in FM 101-5, four "housing systems" were discussed in chapter three and are considered as four possible courses of action (COA's). These four COA's are titled Tent (which is the present GP large tent system), the FSP presented in this thesis, the DRASH, and the ASSTC.

In an attempt to more objectively define the important characteristics (presented in chapter three) in order to "judge" which is the best COA, one must consider using a Wargame. A wargame is a fictional situation or set of situations that the COA is likely to encounter in real life. As these wargame situations are applied to each characteristic, important criteria tend to become apparent.

From this wargame exercise, one should be able to determine which of the characteristics is the most important, which is second, and the rest soon become equal. Additional points are then assigned to the most two important criteria. These points are added, and the COA with the most points is usually the recommended COA.

Factors that can enter into the wargame are: past experience, knowledge of current doctrine, and future trends. This is why the first two chapters included just such a background.

Characteristics in The Wargame

The following characteristics were noted to be important: mobility, initial cost, floor space, transportability, tolerates robust weather, ease set up on unleveled ground,

maintenance requirements, power requirements, availability to field, ease of concealment, and environmental control.

Mobility is important can be considered the theme of this thesis. The ability quickly (set up) or establish in the shortest amount of time is only part of mobility. Given that there are only six operational FST's, a situation of having to quickly disestablish, up load (pack), and re-establish would be important. This increase in mobility would allow more versatility in the use of the FST to be established in the area of greatest need at the appropriate time. In order to judge this characteristic, the number of personnel will be multiplied by the "establish time" will estimate the "amount of work" required. This will be compared to the actual set up time to give an overall score. A lower score for the overall time equates to a better ranking for that COA.

Cost is easy to objective judge, the less expensive the better. A lower cost must still meet medical mission requirements, and all the COA's meet these requirements. This keeps the lowest bidder from always being the favorite.

Floor space is a concern, there must be enough room to perform the medical mission, and all the COA's do. The more floor space, the better, especially when there is a mass casualty in the wargame situation during harsh weather. However, increased floor space can adversely affect other characteristics.

Transportability is another characteristic. The more different types of vehicles and aircraft that the COA can use, the greater the versatility in the medical support plan. Sling load operations is one of the fastest ways the Army can transport something. What assets for sling load operations are available in the forward support battalion? First, one needs helicopters. Three UH-60 helicopters are attached to the forward support

battalion's medical company for medical evacuation.¹ There are several medics, and medics have been successfully cross-trained in how to rig equipment for sling load operations.² Therefore, the ability to be sling loaded under a UH-60 is deemed the most significant aspect of the transportability characteristic.

The Army must perform in all types of harsh weather. Humanitarian relief is a growing area of responsibility. Since humanitarian relief often follows a natural disaster, the ability to tolerate robust (harsh) weather is important to the mission. All the COA's can tolerate various amounts of heat, cold, snow and rain. However, the most common world wide natural disaster is flooding.³ Therefore the ability to tolerate standing ground water was used to judge the weather characteristic.

Unleveled ground is also common to soldiers in the field. COA's requiring flooring can become damaged by rocky ground. Sloped ground can affect the medical equipment, and the ability to tolerate a slope is also important.

Power requirements equate to: less is better (in both wattage and in the number and size of the necessary generators).

Maintenance requirements are qualified as the number of parts of the "housing system" and their durability.

Availability is judged on the access by the Army to its requisition system, and by the number in stock ready for sale.

Ease of concealment is a factor in the "housing system" to visually "hide." A numeric criteria is the height of the system. The taller the system, the less available sites in which to "hide" due to restrictions in the local vegetation.

Environmental controls are not only important to the comfort of the patients and the medical personnel, harsh temperatures can adversely affect the medical equipment as well. Available air-conditioning and heating is much preferred. The availability of vents and fans to circulate the air can also be helpful.

Adding Weight to the Two Most Important Criteria

The process of selecting the most important characteristic, and second most important, should be made objectively. Objective reasoning uses knowledge of doctrine, outcomes in the wargame, commander's intent, with past experience being the least objective.

Given that mobility has been the most emphasized criteria in this thesis, the time needed to establish/disestablish/unload is the most important characteristic.

The second most important is cost. Given the past, present and future budget constraints, and the need to produce many more FST's, was the reasoning behind choosing cost as number two of the criteria. The rest of the criteria will be equally weighted (i.e. compared) against each other.

¹U.S. Army, FM 8-10-6, Medical Evacuation in a Theater of Operations, (Washington, Department of the Army, Oct. 1991) 2-1.

²Andrew Chmar, "Changes in Light Infantry Logistics," Army Logistician (July 1996) 21.

³www.ABCnews.com (Mar. 1999).

CHAPTER FIVE

COURSE OF ACTION MATRIX AND COURSE OF ACTION RECOMMENDATION

Introduction

Following the MDMP, each of the four COA's were "judged" against the previously presented characteristics. This generated the matrix presented as table 1. The COA with the highest score is almost always the recommended COA. (Rarely, one of the COA's can not be done do to a recent change in the mission.)

COA Matrix

Each of the rankings will be discussed, so the reader can agree or not with the logic behind the decisions.

Mobility was the most important characteristic, so it was multiplied by a factor of three. As noted before, the FSP could be taken down and set up in a total of five minutes each. It is the best for total time and "estimated work." The DRASH was second as it took less "estimated work" and had a very similar establish time. The ASSTC was third as it required a similar number of personnel to the Tent, but had a much faster establish time over the Tent. This also assumes that the ASSTC is easier to set up again in windy, rainy weather, versus the soaked canvas of the Tent.

Cost was the second most important criteria, and it was multiplied by a factor of two. The cost was the easiest and the most objective of the rankings. This is not just the initial cost, but also the cost to replace if it becomes damaged or lost in combat. The Tent was clearly the first choice. The FSP was second. Both the GP large tent and the MKT can be obtained as a used item for "free" to the military as discussed in chapter three.

The DRASH was significantly more expensive than the FSP, and two ASSTC's are very costly.

Floor space is important, and this was the only lowest score for the FSP.

Remember that the usable space for each ASSTC is less than the reported 700 square feet, so the GP large tent was ranked the same. The DRASH provided the largest floor space.

Transportability was ranked lowest for the DRASH as it could not be sling-loaded by the UH-60 helicopter. The ASSTC was ranked the same as the FSP as both COA's require two UH-60's for a sling load. The Tent only needs one lift asset to move it.

The ability to tolerate wind, and rain, and snow are important, but the distinguishing factor was the COA's ability to tolerate ground water. Given that the FSP is the only COA that is off the ground it was ranked first. The FSP can tolerate up to 2 feet of ground water before becoming flooded. The ASSTC beat out the DRASH, because of its reportedly improved support (pole) to flooring system. The Tent has no flooring.

The ability to tolerate being established on a slope (of unlevelled ground) is another clear advantage of the FSP. The MKT can level itself on a 20 percent grade by adjusting its supports on its corners, (figure 9). Given its rating and smaller profile, the ASSTC was better than the DRASH to tolerate damage to the floor. The tent has no flooring to damage, so it can better tolerate rough ground.

Maintenance required was minimal for the Tent, and the FSP (only one moving part, which is the top-up roof.) The complicated ASSTC and DRASH tied as well.

Power requirements were only four small 3Kw generators, which fit on the tongue of the sling-loaded FSP (figure 4). The FST requires only 4.734Kw if the electric sink is

replaced by a modified gravity sink¹ (figure 4). This is much less than the 6Kw generated by two of the generators. The FSP is the only COA that does not need a back up generator. The GP large still needs another 5Kw, and both ASSTC and DRASH have the same 15Kw requirements.

For the characteristic "available to field," it is still easier to obtain a tent than an MKT, but both are much easier to get than the DRASH. The ASSTC is still not in full production.² This is very important should this piece of equipment be left behind in battle.

If there are low hanging branches, the Tent is too tall to be erected and hiding it would be a problem. Concealment is a function of camouflage, given that the FSP is off the ground it is higher than the ASSTC, it was ranked below the ASSTC. The DRASH is bigger in length, but not height over the Tent.

Environmental control, both the DRASH and ASSTC were far better than the FSP's small heater and air vents. The tent was obviously last.

The Recommended COA for FST

If all the COA's have been ranked subjectively, the COA with the highest score is the recommended COA. The COA with the highest score is the FSP (table 1.) The Tent beat out the DRASH. The DRASH is the current designated replacement for the GP large tent(s). However, the difference was not very significant. Last was the ASSTC, but again it was not much behind the DRASH.

This thesis recommends the FSP as the "housing system" for an FST. This COA would be recommend to a FST or CSH commander for further consideration, and/or a decision to give the FSP a trial.

¹ U.S. Army, FM 8-10-25, Employment of Forward Surgical Teams, Final Draft (Washington: Department of the Army, Nov. 1996) I-3.

² Ed Howze, ASSTC product manager, personal communication.

CHAPTER SIX

FUTURE RESEARCH FROM THIS THESIS

Gaps In Knowledge

The FSP system has not been weighed with all its necessary medical equipment. It is estimated to be about 7000 pounds for one MKT and its equipment (including two 3Kw generators).¹ This is important for the Alpha model of the UH-60 to be able to lift the OPT and the PPT. In accordance with FM 8-10-6, there will be three medevac helicopters attached to the medical company of the brigade's forward support battalion.² To move the essential elements of the FST, (i.e. ten personnel, one ORT, and one PPT) it could be done with the helicopters that are directly under the brigade's control. This would alleviate the command and control problems of having to ask the division or corps for their helicopter lift assets. This also assumes that there will be one FST per maneuver brigade.

If the lima model is needed because the ORT/PPT weighs between 7,000 and 10,000 pounds, then this could be sling-loaded by UH-60's in the division, and/or corps level. The medical supply estimation to the known trailer weight is not expected to weigh over 10,000.

A Better FSP

As the research regarding this thesis continues, I have gotten further feedback to add another PPT to the FSP package. This was at the strong suggestion of LTC Joanne McGovern who was formerly attached to the sixty-seven FST in Germany (the only FST in Germany). The second PPT would provide the additional recovery litter assets that

are strongly recommended in the field manual.³ She also said that it must fit on a C-130, Air Force cargo plane. The cargo area of the C-130 is seven by forty-eight and one half feet.⁴ Three adapted MKT's (six by sixteen feet) should just fit into one C-130. She mentioned making the FST more self-sustainable. There is enough room and weight to have thirty gallons of water, four boxes of MRE's (meals ready to eat), and twenty gallons of fuel for the generators. This would make the ten-person FST, almost self-sustainable (at least for the first twelve hours.) There is still the matter of security and communications, which the FST must rely heavily on another unit for. I believe that the possibility of a satellite, or AM communication should be explored.

The Battalion Aid Station and the ATT

The battalion aid station for the light infantry, air assault, and field artillery battalions (light or heavy) have a GP small tent as the "housing system."⁵ The GP small tent is a round tent sixteen feet in diameter. The side walls are only two feet high, which cut its usable floor space in half to about one-hundred square feet. There is also a center vertical pole, which gets in the way. Unfortunately, only one litter can be set-up that will allow the medics to work on both sides of the injured soldier at the same time. The set-up of the battalion aid station includes off-loading and setting up four to eight medical chests. These chests are not compartmentalized and the medical supplies often become scrambled in the transportation to the field.

The battalion aid station has up to thirty minutes to set-up the tent, litter and off-load the medical supplies according to the army standard (ARTEP).⁶ Of course it takes even longer to tear down, move and set-up again. If the Army of the near future is to be

more mobile, then this set-up time must be shortened, and the medical supplies haul capacity must be improved. The transportability must also be improved, especially as helicopter sling loads are becoming more common.

These are the exact parameters that were noted by the author during after action reviews conducted with light infantry units at the NTC and JRTC.^{7 8} It was after the initial NTC rotation, that the MKT was non-permanently modified and called an Airmobile Trauma Trailer (ATT) as drawn in figure 8. It was noted that the patients were easily carried up the stairs to the outside pathway of the ATT. Then, with the help of the medics and/or doctor on the inside pathway of the ATT, the patient was lifted up, and placed on the litter rack. Note that the burners were removed, so this piece of equipment can not function as an MKT. It could easily be converted back to an MKT (and was, after the exercise was over.) The ATT was later field tested at the NTC with the BAS of a field artillery battalion under sling-load operations, which were highly successful.⁹

What are the advantages of the ATT over the BAS with its GP small tent? There is more room (140 square feet versus 100 functional square feet.) Unlike a tent, the ATT can not blow down (can withstand a forty-five mph wind), nor can it flood as it is twenty-four inches off the ground. It has 120 cubic feet of storage, which equals over thirteen medical chests. This equals approximately 1,300 pounds (Only six medical chests are required to be carried.) The ATT is ventilated, and therefore cooler than the tent. It takes only five minutes to unfold it, and the medical supplies are already set up in sectioned drawers. Best of all, it can be sling-loaded by a UH-60. This sling-load can be done under most weather conditions by the Alpha model of UH-60, and under all visible

weather conditions by the Lima UH-60.¹⁰ The alpha model is the one most flown by the medevac units.

The ATT also could be used by the forward element of a brigade's medical company, or by a quick reactionary force (QRF), or by a disaster area relief team (DART), or by any medical element on an OOTW mission.

The Recommended COA for the BAS

Why was there no decision matrix for the GP small tent of the BAS, versus the ATT? Given that there were only two COA's, a ranking matrix is usually not necessary. The criteria of cost was not directly compared. The cost of a GP small tent is \$1,100 as compared to a new MKT of \$23,000.¹¹ This would be quite a difference, except that many battalions have three MKT's when only two are required to prepare the modern t-rations.¹² Therefore, it would be relatively easy for a battalion commander to try the ATT concept. If the ATT did not meet his needs, then there is no cost (as the litter racks can be sold back). Most of the criteria mentioned in the FST matrix would be clearly in favor of the ATT over the GP small tent.

As for the ATT, the Marine Forces Pacific Surgeon, is very interested in trying this concept (CAPT Rich Jefferies). I will coordinate him borrowing or buying an Army MKT through the 25th ID Surgeons office (LTC Mike Sigmon).

A battalion commander of the 101st Air Assault Division is interested in trying the ATT concept at Fort Campbell, KY. His name is LTC John Lehr, and he will first discuss this project with his physician assistant and medical platoon leader.

Recommendations

This thesis appears to be a work in progress. I wish to express my appreciation to those people in the acknowledgment section, and to all those who have assisted in this project. This should not be the last of the adapted MKT concept for use as a medical platform.

¹U.S. Army, FM 55-450-4, Sling-load Operations, (Washington: Department of the Army, Aug. 1982) 2-49.5

²U.S. Army, FM 8-10-6, Medical Evacuation in a Theater of Operations, (Washington: Department of the Army, Oct. 1991) 2-1.

³U.S. Army, FM 8-10-25, Employment of Forward Medical Teams, Final Draft, (Washington: Department of the Army, Nov. 1996) 4-9.

⁴U.S. Air Force, USAF FACT SHEET 92-34, C-130 Hercules, (Washington: Department of the Air Force, Oct 1992) 2.

⁵U.S. Army, FM 63-2-1, Division Support Command, (Washington: Department of the Army, Sep. 1994) 7-1.

⁶U.S. Army, ARTEP 70-3, Mission Training for the Light Infantry Brigade, (Washington: Department of the Army, Oct. 1988) 1-2.

⁷Todd Dombroski, AAR - Medical with BAS of 101st ID at NTC, (Aug. 1992).

⁸Todd Dombroski, AAR - Medical with BAS of 82nd AA at JRTC, (Aug. 1995).

⁹Todd Dombroski, AAR - ATT at the NTC with 4-41 FA, (Apr. 1993).

¹⁰Bill Grimes, UH-60 (medevac) pilot, personal communication, (Mar. 1999).

¹¹Fedlog, a computer listing of military products and prices, (Apr. 1999).

¹²Don Carnes, former 3rd BDE - 24 ID, S4, personal communication.

ILLUSTRATIONS

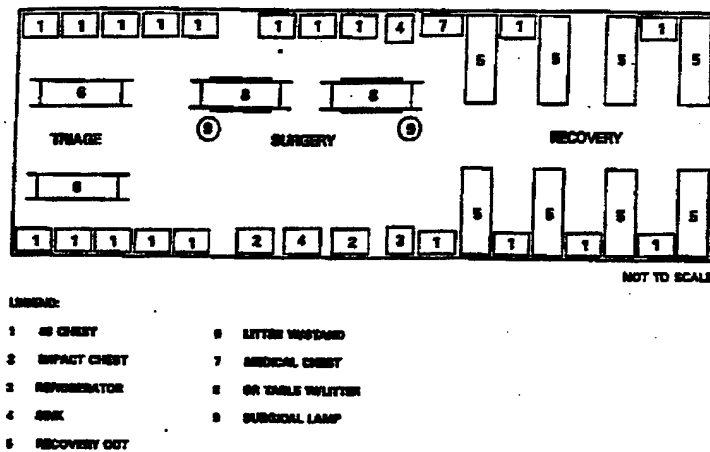
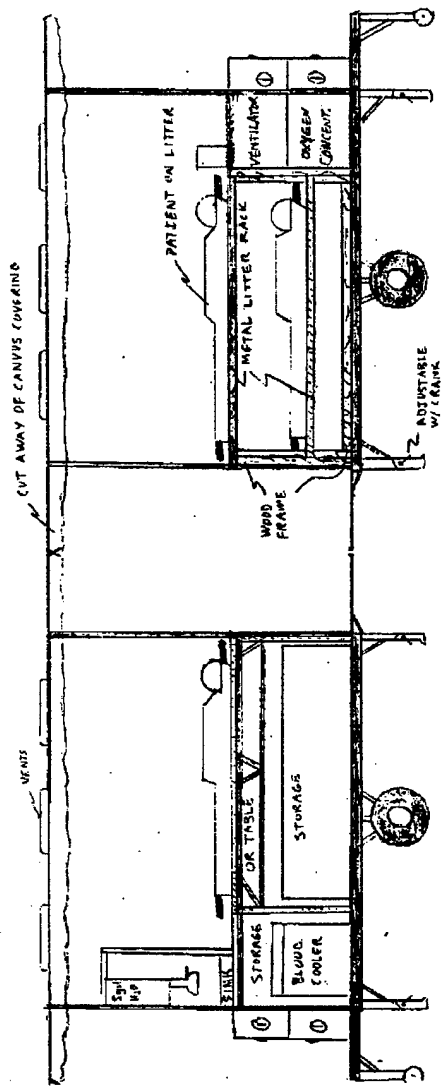


Figure 1. Forward Surgical Team layout in one general purpose large tent.



SCALE 1cm = 1.5 feet

Figure 2. The Forward Surgical Platform (side view)
 Operation Room Trailer (ORT) on the left, and
 Pre-op/Post-op Trailer (PPT) on the right

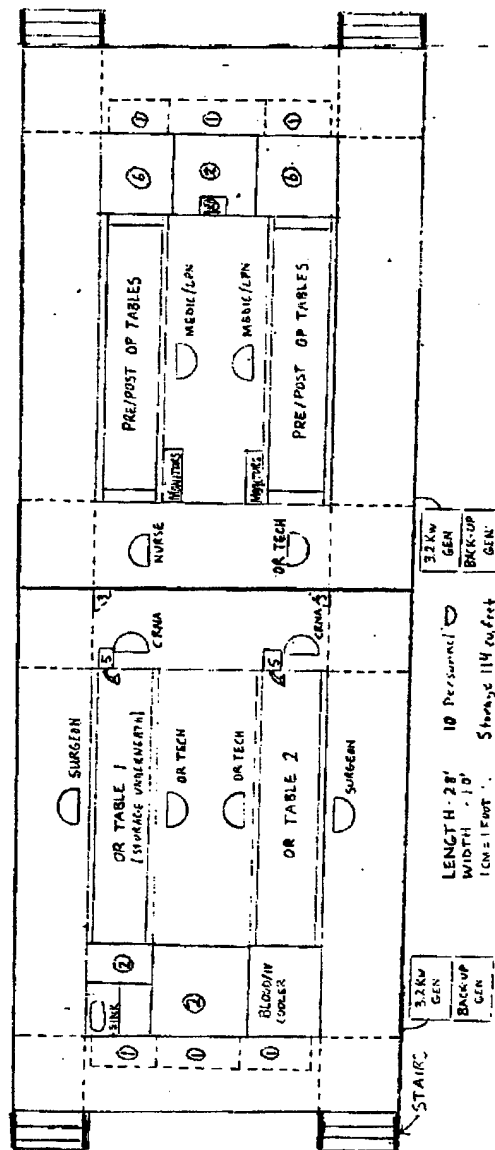


Figure 3. The Forward Surgical Platform (overhead view).

- 1 = movable storage containers
- 2 = fixed storage containers
- 3 = mobile anesthesia drug case
- 4 = heater/fan
- 5 = overdrift anesthesia machine
- 6 = ventilator over an oxygen concentrator
- CRNA = Certified Registered Nurse Anesthetist
- location of personnel

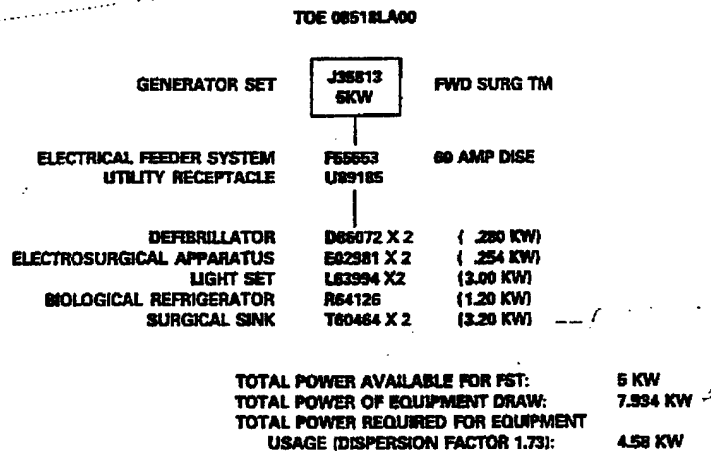


Figure 4. Power distribution for an FST

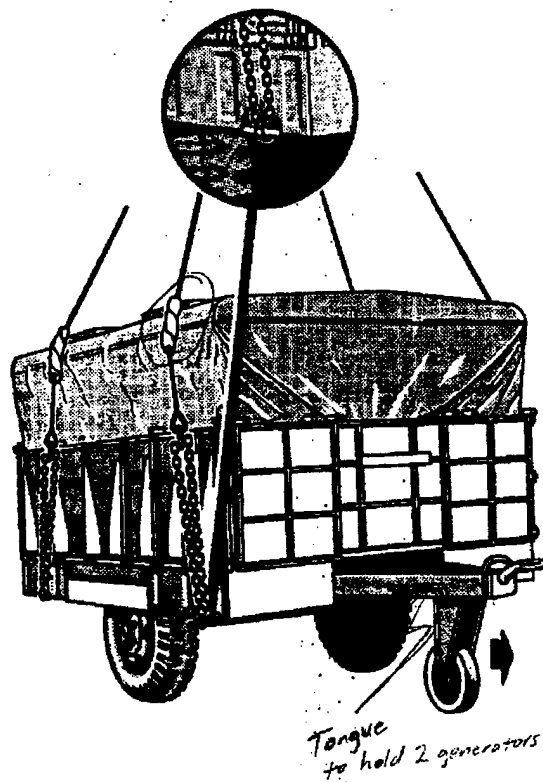


Figure 5. Mobile medical platform in a sling-load configuration

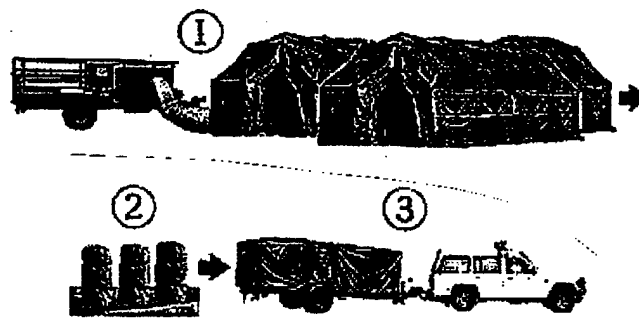
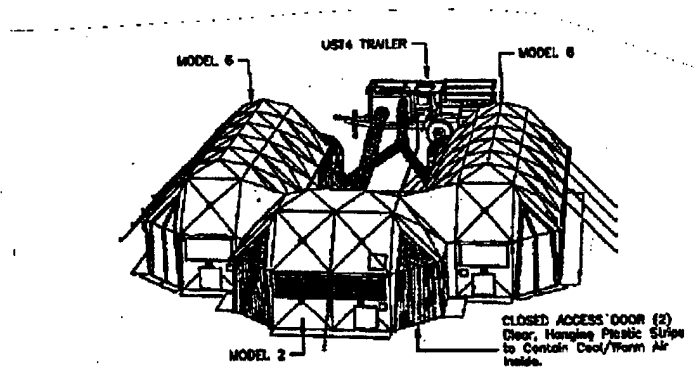


Figure 6. The Deployable Rapid Assembly Surgical Hospital (DRASH)
(regular setup, and in the transport configuration)

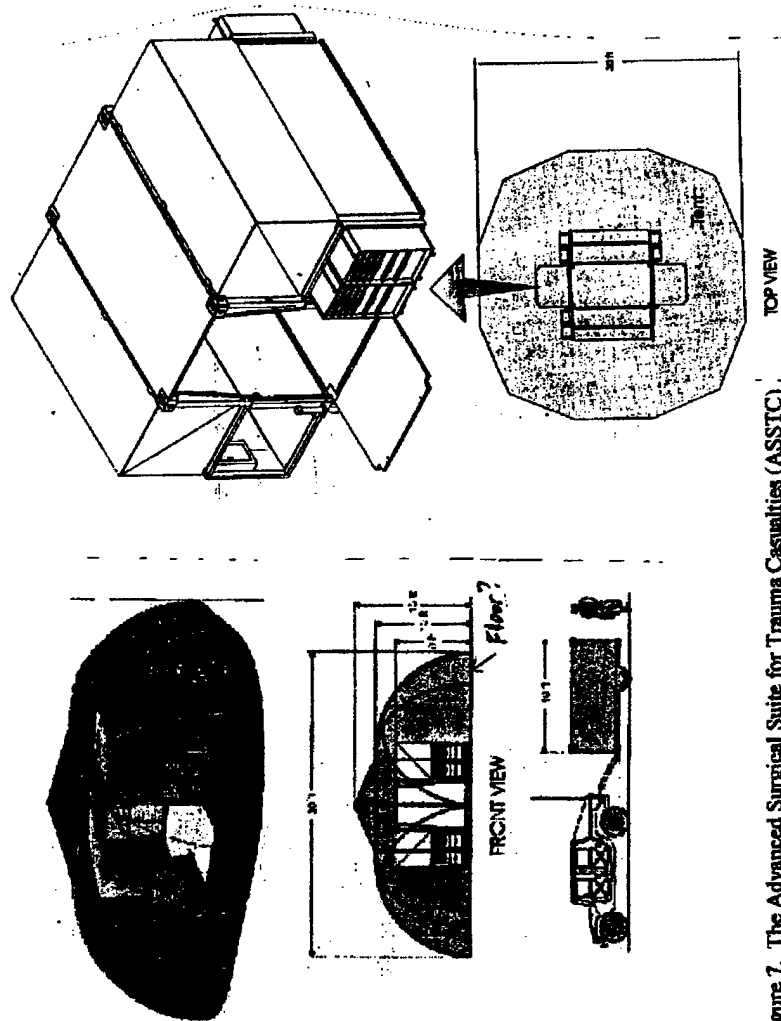


Figure 7. The Advanced Surgical Suite for Trauma Casualties (ASSTC)

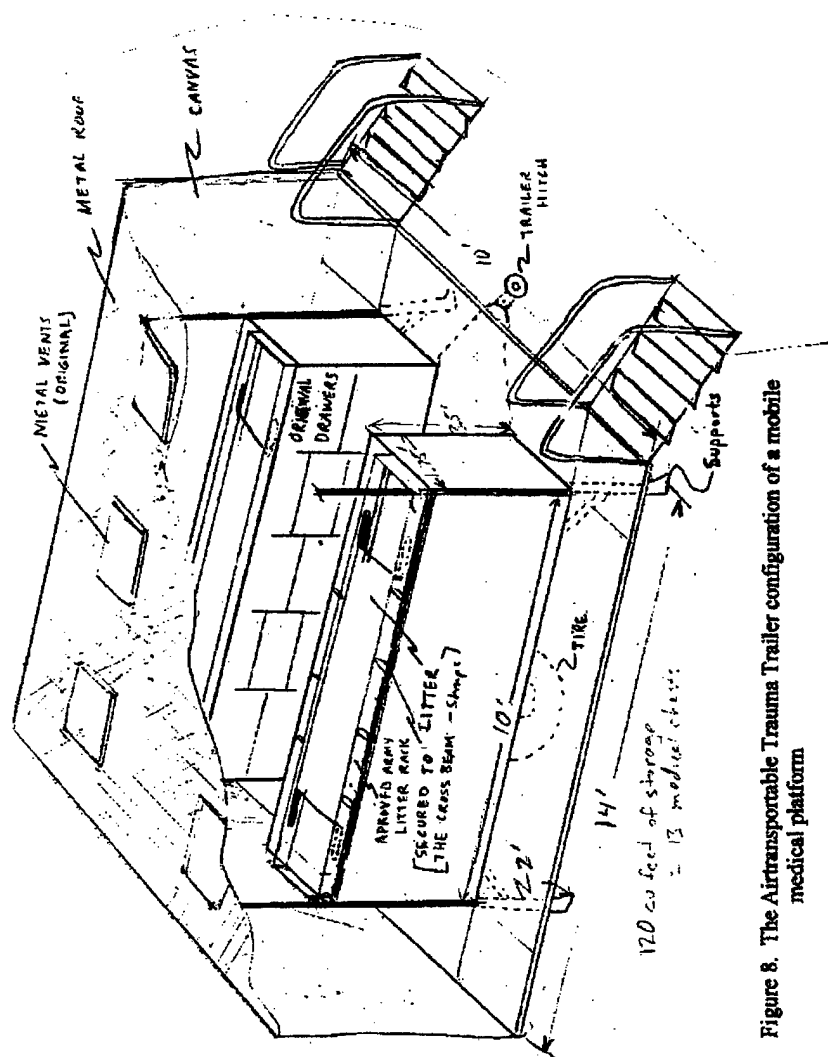


Figure 8. The Airtransportable Trauma Trailer configuration of a mobile medical platform

COA Matrix for FST

	Tent	FSP	DRASH	ASSTC*
Mobility (x 3)	3	12	9	6
Cost (x 2)	8	6	4	2
Floor space	2.5	1	4	2.5
Transportability	4	2.5	1	2.5
Weather (robust)	1	4	2	3
Uneven ground (sloped)	3	4	1.5	1.5
Maintenance req.	3.5	3.5	1.5	1.5
Power req.	3	4	1.5	1.5
Avail. to field	4	3	2	1
Ease of Concealment	1	3	2	4
Environmental Control	1	2	3.5	3.5
TOTALS	34	<u>45</u>	32	29

*ASSTC is two "tents" in order to have two OR tables

Table 1. Course of Action Matrix for "housing" an FST

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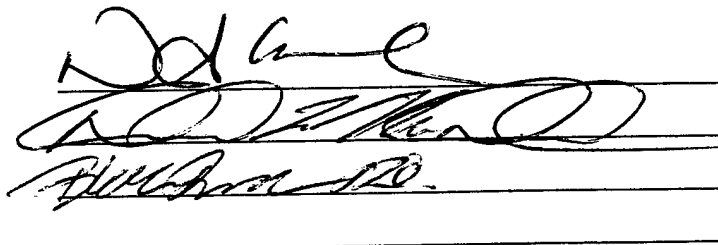
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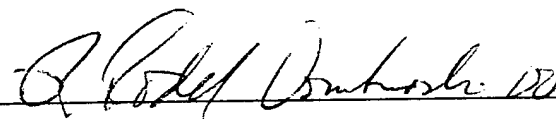
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